



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

Powai, Mumbai - 400076

Date :- 13.08.2026

Addendum – I

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Gas Distribution and Utility Services

The additional Detailed Technical Specification with Drawings has been uploaded on IITB Website for the above Tender.

Link : <https://www.iitb.ac.in/tenders/gas-distribution-and-utilities-services>

Sealwankar
13/8/2026

Assistant Registrar

Materials Management Division



TENDER DOCUMENT OF
LABORATORY GAS
DISTRIBUTION & UTILITIES
SERVICES

TENDER DOCUMENT OF LABORATORY GAS DISTRIBUTION, UTILITIES SERVICES

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1) BUILDING DESCRIPTION

The project is located within the campus of Indian Institute of Technology Bombay, Powai, specifically in the IITB ASPIRE Research Park.

The facility comprises advanced research laboratories situated on the second floor of the building, including:

- Battery Laboratory
- Hydrogen (H₂) Laboratory

2) INTRODUCTION AND BRIEF DESCRIPTION OF PROJECT

This project involves the design, engineering, supply, installation, testing, and commissioning of a comprehensive laboratory gas distribution system along with an integrated gas detection and safety system for the Battery and Hydrogen laboratories.

2.1 BRIEF SCOPE OF GAS BANK

A total of two (2) gas banks shall be installed on the second floor of the building:

Gas Bank 1: Dedicated to the Battery Laboratory

Gas Bank 2: Dedicated to the Hydrogen (H₂) Laboratory

Both gas banks shall be located on the north side of the building, as indicated in the approved second-floor layout drawings.

2.2. GAS BANK DISTRIBUTION

GAS BANK

- Oxygen – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV.
- Carbon Di Oxide – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV
- Hydrogen – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV, FLASHBACKARRESTOR
- Nitrogen – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV
- H₂S – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV, FLASHBACK ARRESTOR
- Argon – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV
- Zero Air – (1+1): Consisting of high pressure manifold for 2 cylinder with double

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stage cylinder regulator, Flexible hose, Check valve, NRV

- Carbon di-oxide – (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV, Preheater
- RG– (1+1) FOR THE GLOVE BOX: Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV
- Helium– (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV
- Carbon Monoxide– (1+1): Consisting of high pressure manifold for 2 cylinder with double stage cylinder regulator, Flexible hose, Check valve, NRV
- Compressed Air: Considered Tapping from gas bank location.
- VACUUM: Considered Tapping from gas bank location.

2.3. GAS DETECTION SYSTEM

Gas Detection System: Gas sensors to be installed in respective Labs & Gas bank these sensors should have capability of detecting down to PPM, % LEL & % V/V as per the Gas services used in these respective Labs. Each sensor will be operated on 24V DC supply.

In case of Gas Leakage at any point of time will be sensed by the sensors provided in the Lab and Gas Bank. These sensors will provide feedback to the GMS Panel which will give alarms in the leak level to alert user.

Gas Leak Detectors are required Carbon Dioxide, Hydrogen, Nitrogen, Carbon monoxide, Hydrogen Sulphide

GMS panel will have different relays which will be activated in case of leakage of gas. This relay will activate hooter and solenoid valve.

We have quoted gas detection system which will have Low-level & High-level alarm. Shutdown valve will be provided, if there is leakage of gas it will be detected and cut-off

supply of gas from cylinder area with help of solenoid valve.

GMS panel will also have compatibility suitable for BMS & Fire and Alarm System.

For the detection system and GMS panel & Gas detector & cable, cable tray & Accessories will be in vendor/bidder scope.

For O₂, low level alarm will be at 19.5%

v/v high level alarm will be at

21.5% v/v

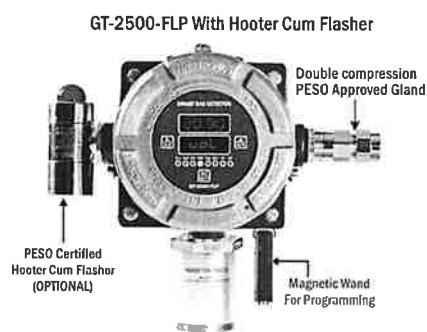
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For CO₂, low level alarm will be at
250ppm high level alarm will
be at 500ppm

For H₂, low level alarm will be at 20% lel
high level alarm will be at 40% lel

For H₂S, low level alarm will be at 20% lel
high level alarm will be at 40% lel

For CO, low level alarm will be at 20% lel
high level alarm will be at 40% lel



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3) CODES AND STANDARDS

The installation shall comply with the following applicable standards and codes:

Sl. N	Item Description	Standards & Codes	Remarks
1	Piping Design	ASME B31.3 & B31.8	American / EN Std.
2	SS316 Pipe	ASTM A312 TP316	American / EN Std.
3	SS304 Pipe	ASTM A312 TP304	American / EN Std.
4	SS316/ 304 Tubes	ASTM A269 / 213 TP316/304	American / EN Std.
5	Tubing identification Code	ASME A13.1/IS 2379	American /Indian Std.
6	Gas Cylinder Storage	Gas Cylinder Rule no.44 (2004)	Indian Std.
7	Welding	ASME Section IX	American / EN Std.

All installations shall comply with applicable local authority byelaws and statutory requirements. In case of any conflict, statutory regulations shall prevail. Where this specification demands higher standards of material or workmanship, the same shall take precedence.

4) DRAWINGS AND SPECIFICATIONS

The drawings and specifications shall be considered as part of this contract and any work or materials shown on the drawings and not called for in the specifications or vice versa shall be executed as if specifically called for in both. The contract drawings indicated the extent and general arrangement of the fixtures, drainage system etc., and are essentially diagrammatic.

The drawings indicate the points of supply and termination of pipe runs and broadly suggest the routes to be followed. The work shall be installed as indicated on the drawings, however any changes found essential to co- ordinate this work with other trades shall be made without any additional cost. The date given herein and on the drawings is as exact as could be secured, but its complete accuracy is not guaranteed.

The drawings and specifications are of the assistance and guidance of the Contractor, and exact location distance and levels will be governed by the individual building and site condition therefore approval at the architects shall be obtained before commencement of work.

5) MATERIAL OF CONSTRUCTION (MOC)

S.NO	DESCRIPTION	MOC
CYLINDER MANIFOLD BOQ		
1	Unistrut Frame 1+1 Cyl. Manifold	GI/MS powder coated
2	Cylinder Bracket with chain	MS
3	Nut Bullnose	SS 316
4	Check Valve	SS 316
5	Braided flexible Hose ,1 Mtr Long with safety wire	SS 316
6	High Pressure Manual panel with Manifold for 2 cylinder with PRV 1/4" NPTF with double stage cylinder regulator (Flow : 350 LPM)-SS 316 Inlet Pr. 150 bar Outlet Pr. 14 bar along with mounting plate	Brass Chrome Plated
7	Outlet Connector	SS 316
8	Outlet Connector	SS 316
9	Ball Valve	SS 316
10	Ball Valve	SS 316
11	Flashback Arrestor with connectors	brass
12	Preheater	

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LAB PIPING AND ACCESSORIES		
1	Source Connector	SS 316
2	Ball Valve	SS 316
3	Ball Valve	SS 316
4	Ball Valve	SS 316
5	Instrument connector	SS 316
6	Fumehood connector	SS 316
7	Equal Tee	SS 316
8	Equal Tee	SS 316
9	Unequal Tee	SS 316
10	Unequal Tee	SS 316
11	Reducer	SS 316
12	Reducer	SS 316
13	Elbow	SS 316
14	Angle pattern needle valve	SS 316
15	Table Mount Regulator with outlet pressure Gauge and Ball Valve	SS 316
16	Table Mount Regulator inlet connector	SS 316
16	Table Mount Regulator inlet connector	SS 316
17	Line regulator with inlet and outlet pressure Gauge and mounting plate	SS 316
18	Regulator connector	SS 316
19	Regulator connector	SS 316
	Pressure gauge with necessary tee & fittings, etc.	
	Pressure gauge with necessary tee & fittings, etc.	
20	Vacuum gauge with necessary tee & fittings, etc.	
21	Vacuum gauge with necessary tee & fittings, etc.	
22	Seamless Tube,	SS 316
23	Seamless Tube,	SS 316
24	Seamless Tube,	SS 316
25	Box Clamp with tee nut & SS Allen Screw	PP

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26	Box Clamp with tee nut & SS Allen Screw	PP
27	Box Clamp with tee nut & SS Allen Screw	PP
28	Tagging	Acrylic
29	Anchor fastner 10 MM with 10mm stud rod, nuts, washers & accessories (1.0 mtr length)	GI
30	Aluminium profile with end caps	AL
31	Slotted Channel	
32	SS Support like ceiling plate, MS angle, grid supports, etc.	SS 316
33	Aluminium powder coated service dropper 150mm X 300mmX5.5 mtr	
33	Aluminium powder coated service dropper 150mm X 300mmX3.5 mtr	
Total		

6) TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATION	IMAGE
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CYLINDER MOUNTING BRACKETS		
a.	Type	Wall mounted brackets
b.	Qty.	As per BOQ
c.	Make	P-Lok / Astech / Panam or Substantive equivalent
d.	MOC	MS / GI / SS
e.	Body	MS, Fabricated with epoxy paint
f.	Belt	Nylon with Velcro
g.	Chain	SS 316

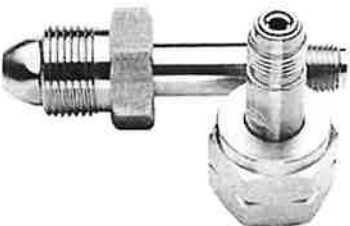


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FLEXIBLE HOSE			IMAGE
a.	Type	Flexible Pigtail (High Pressure) with safety rope	
b.	Qty.	As per BOQ	
c.	Make	P-Lok / Astech / Panam or Substantive equivalent	
d	MOC	Internal & External SS 316 with Braiding	
e	Size	1/4" OD with internal SS	
f	End connection	1/4" BSPF both end	
g.	MAX Working Pressure	150 bar	

CHECK VALVE			IMAGE
a	Type	Check Valve	
b	Qty.	As per BOQ	
c	Make	P-Lok / Astech / Panam or Substantive equivalent	
d	MOC	SS 316	
e	End connection	1/4" BSPM X 1/4" BSPF (for High Pressure) 1/4" OD (for Low Pressure)	
f	MAX Working Pressure	150 bar	

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CYLINDER CONNECTION BULLNOSE			IMAGE
a	Type	Nut and Bullnose	
b	Qty.	As per BOQ	
c	Make	P-Lok / Astech / Panam or Substantive equivalent	
d	MOC		
	Bull nose	SS 316	
	Nut	BRASS	
g	End connection	5/8" BSPM X 1/4" BSPM	
h	MAX Working Pressure	150 bar	

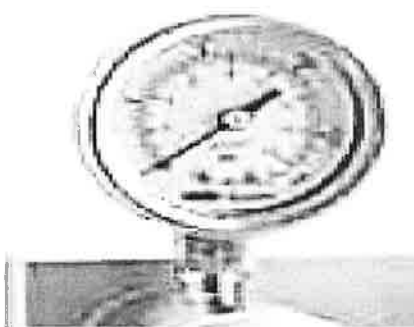
PRE-HEATER			IMAGE
a.	Type	PRE-HEATER	
b.	Qty.	As per BOQ	
c.	Make	Indigenous	
d.	MOC		
e.	MAX Working Pressure	150 bar	
f.	Inlet & Outlet Connections	1/4" OD	

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FLASH BACK ARRESTOR			IMAGE
a.	Type	Flash back Arrestor	
b.	Qty.	As per BOQ	
c.	Make	Messer/GCE/WITT or Substantive equivalent	
d.	MOC	Brass	
e.	MAX Working Pressure	10 bar	
f.	Inlet & Outlet Connections	3/8" BSPF x BSPM	

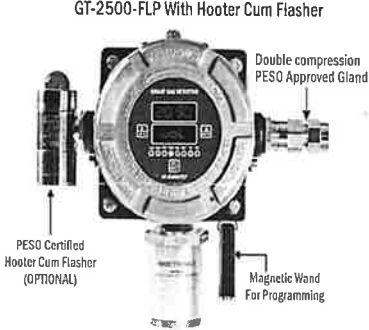
High Pressure Manual With Manifold with double stage cylinder			IMAGE
a.	Type	High Pressure Manual panel with Manifold for 2 cylinder with PRV 1/4" NPTF with double stage cylinder regulator	
b.	Qty.	As per BOQ	
c.	Make	P-Lok / Astech / Panam or Substantive equivalent	
d.	MOC	SS316	
e.	Body	SS316	
f.	Internals	SS316	
g.	Diaphragm	SS 316	
h.	Inlet Pressure (kg/cm ² (g))	150 bar	
i.	Outlet Pressure (kg/cm ² (g))	14-15 bar	

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PRESSURE GAUGE			IMAGE
a.	Tech. Name	Pressure Gauge	
b.	MOC	SS316	
c.	Range	0-100 Bars	
d.	Dial Size	2 1/2"	
e.	Pressure Range	0-10, 10-80, 0-120, 0-200, 0-300 Bars	
f.	Accuracy	-0.01	
g.	Connection	1/4" BSPM	
h.	Make	Wika/Baumer or Substantive equivalent	
i.	Type	Bottom Entry	

PIPE HOLDING CLAMPS			IMAGE
a.	Tech. Name	Pipe Holding Clamps	 PP Clamp
b.	MOC	Polypropylene	
c.	Size	1/4" OD to 1" OD	
d.	Ref. Standard	ASME13.1-2007	
e.	Make	P-Lok / Stuff / Unistrut or Substantive equivalent	

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Gas Detection System			IMAGE
	Gas to be detected	H ₂ S,CO ₂ ,CO,H ₂ ,O ₂	GT-2500-FLP With Hooter Cum Flasher 
a.			
b.	Output	4 to 20 mA	
c.	Supply Voltage	24 V DC	
d.			
e.	Sensor Body	SS316	
f.	Mounting	Wall mounting OR stand mounting	
g.	Display	With display	
	Gas to be detected	H ₂ S,CO ₂ ,CO,H ₂ ,O ₂	
a.	Range	V/V,LEL,PPM based on detector type	
b.	Detection Method	Electrochemical ,IR, Catylic Bead	
c.	Display	With Display	
d.	Setting	NA	
e.	Supply Voltage	24 V DC	
f.	Standard output	4 to 20 mA Current output	
g.	Error detection	NA	
h.	Operating temperature	15° C to 55° C	
i.	Protection Class	Flame proof	

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Multi Channel Gas Monitor Unit		
a	MOC of Body	Polycarbonate/ MS Powder Coated
b	Input	8/16/24/32 Channel, 4 to 20mA output from Oxygen / Toxic / Combustible Gas Transmitter of 2 wire/3wire
c	Range	0 to 9999 programmable by user, reads % LEL , PPM or %V/V
d	Control Action	LO/HI, HI/LO, LO/Very LO & HI-very HI, Programmable by user.
e	Resolution	0.01, 0.1, 1 programmable by users
f	Power Supply	230V AC $\pm$ 10%
g	Protection Class	IP 65
h	LED Indication	8 No. RED LED for Alarm Indications of both set points AL1, AL2
i	Mounting	Wall Mounting / Stand Mounting

IMAGE



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SEAMLESS TUBE FOR UTILITIES			IMAGE
a.	Type	Seamless Tube	
b.	Make	Scoda/ Sumitomo / Prakash or Substantive equivalent	
c.	MOC	SS 316	
d.	MAX Working Pressure	150 bar	
e.	Size	1/4" OD , 1/2" OD & 1"OD Thickness as per standard	

TUBE FITTINGS FOR UHP GASES			IMAGE
a.	Type	Tube Fittings Compression Fitting/ Orbital Weld/ Threaded Fittings	
b.	Make	P-Lok / Astech / Panam or Substantive equivalent	
c.	MOC	SS 316	
d.	MAX Working Pressure	150 bar	
e.	Size	1/4" OD to 1/2" OD	

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INLINE REGULATOR AND BENCH MOUNTED REGULATOR FOR UTILITIES SERVICES			IMAGE
a.	Type	Inline pressure regulator with inlet and outlet pressure gauge	
c.	Make	P-Lok / Astech / Panam or Substantive equivalent	
d.	MOC	SS 316	
e.	Body	SS 316	
f.	Internals	SS 316	
g.	Diaphragm	SS 316	
h.	Inlet Gauge Range	0 to 16 bar	
i.	Outlet Gauge Range	0 to 10 bar	
j.	Inlet connection	1/4" NPTF	
k.	Outlet connection	1/4" NPTF	
l.	Flow	150 Lpm @ 7bar	

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BALL VALVE FOR UTILITIES			IMAGE
a.	Type	Three Piece Ball Valve	
c.	Make	P-Lok / Astech / Panam or Substantive equivalent	
d.	MOC	SS 316	
e.	Working Pressure	40 Bar	
f.	Inlet & Outlet Connection	1/4" to 1/2" OD	
g.	Lower Packing Material	PTFE	

7) UTILITY & GAS COMSUMPTION WITH DIVERSITY FACTOR

'SR. NO.	SERVICES	TOTAL FLOW LPM	VELOCITY M/S	DIVERSITY	Tube Size MAIN HEADER INCH
1	NITROGEN	108	18	100%	1/2"OD
2	HELIUM	2	18	100%	1/4"OD
3	HYDROGEN	4	18	100%	1/4"OD
4	OXYGEN	17	18	100%	1/4"OD
5	ZERO AIR	1	18	100%	1/4"OD
6	COMPRESSED AIR	55	18	100%	1"OD
7	VACUUM	95	18	100%	1"OD

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8	ARGON	26	18	100%	1/4"OD
9	CARBON DI OXIDE	1	18	100%	1/2"OD
10	HYDROGEN SULPHIDE	1	18	100%	1/4"OD
10	CARBON MONOXIDE	1	18	100%	1/2"OD
11	ARGON FOR GLOVEBOX	15	18	100%	1/2"OD
12	N2 FOR GLOVEBOX	15	18	100%	1/2"OD
13	RG FOR GLOVEBOX	15	18	100%	1/2"OD

8) MAKE LIST

S.NO	DESCRIPTION	Make
1	Unistrut Frame 1+1 Cyl. Manifold	Fabricated
2	Cylinder Bracket with chain	Fabricated
3	Nut Bullnose	P-Lok/Astec/Panam or Substantive equivalent
4	Check Valve	P-Lok/Astec/Panam or Substantive equivalent
5	Braided flexible Hose ,1 Mtr Long with safety wire	P-Lok/Astec/Panam or Substantive equivalent
6	High Pressure Manual panel with Manifold for 2 cylinder with PRV 1/4" NPTF with double stage cylinder regulator (Flow : 350 LPM)-SS 316 Inlet Pr. 150 bar Outlet Pr. 14 bar along with mounting plate	P-Lok/Astec/Panam
7	Outlet Connector	P-Lok/Astec/Panam or Substantive equivalent

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8	Outlet Connector	P-Lok/Astec/Panam or Substantive equivalent
9	Ball Valve	P-Lok/Astec/Panam or Substantive equivalent
10	Ball Valve	P-Lok/Astec/Panam
11	Flashback Arrestor with connectors	Messer or Substantive equivalent
12	Preheater	Indigenous
1	Source Connector	P-Lok/Astec/Panam or Substantive equivalent
2	Ball Valve	P-Lok/Astec/Panam or Substantive equivalent
3	Ball Valve	P-Lok/Astec/Panam or Substantive equivalent
4	Ball Valve	P-Lok/Astec/Panam or Substantive equivalent
5	Instrument connector	P-Lok/Astec/Panam or Substantive equivalent
6	Fumehood connector	P-Lok/Astec/Panam or Substantive equivalent
7	Equal Tee	P-Lok/Astec/Panam or Substantive equivalent
8	Equal Tee	P-Lok/Astec/Panam or Substantive equivalent
9	Unequal Tee	P-Lok/Astec/Panam
10	Unequal Tee	P-Lok/Astec/Panam
11	Reducer	P-Lok/Astec/Panam
12	Reducer	P-Lok/Astec/Panam
13	Elbow	P-Lok/Astec/Panam
14	Angle pattern needle valve	P-Lok/Astec/Panam or Substantive equivalent
15	Table Mount Regulator with outlet pressure Gauge and Ball Valve	P-Lok/Astec/Panam or Substantive equivalent
16	Table Mount Regulator inlet connector	P-Lok/Astec/Panam or Substantive equivalent
16	Table Mount Regulator inlet connector	P-Lok/Astec/Panam or Substantive equivalent

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17	Line regulator with inlet and outlet pressure Gauge and mounting plate	P-Lok/Astec/Panam or Substantive equivalent
18	Regulator connector	P-Lok/Astec/Panam or Substantive equivalent
19	Regulator connector	P-Lok/Astec/Panam or Substantive equivalent
20	Pressure gauge with necessary tee & fittings, etc.	Baumer/Wika or Substantive equivalent
21	Pressure gauge with necessary tee & fittings, etc.	Baumer/Wika or Substantive equivalent
22	Vacuum gauge with necessary tee & fittings, etc.	Baumer/Wika or Substantive equivalent
23	Vacuum gauge with necessary tee & fittings, etc.	Baumer/Wika or Substantive equivalent
24	Seamless Tube,	Scoda/Sumitomo or Substantive equivalent
25	Seamless Tube,	Scoda/Sumitomo or Substantive equivalent
26	Seamless Tube,	Scoda/Sumitomo or Substantive equivalent
27	Box Clamp with tee nut & SS Allen Screw	P-Lok/Astec/Panam or Substantive equivalent
28	Box Clamp with tee nut & SS Allen Screw	P-Lok/Astec/Panam or Substantive equivalent
29	Box Clamp with tee nut & SS Allen Screw	P-Lok/Astec/Panam or Substantive equivalent
30	Tagging	P-Lok/Astec/Panam or Substantive equivalent
31	Anchor fastner 10 MM with 10mm stud rod, nuts, washers & accessories (1.0 mtr length)	Indigenous
32	Aluminium profile with end caps	Indigenous
33	Slotted Channel	Indigenous
33	SS Support like ceiling plate, MS angle, grid supports, etc.	Indigenous
34	Aluminium powder coated service dropper 150mm X 300mmX5.5 mtr	Indigenous

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35	Aluminium powder coated service dropper 150mm X 300mmX3.5 mtr	Indigenous
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9) GENERAL INFORMATION

- All components of the gas distribution system, including piping, tubing, fittings, and accessories mentioned in this specification, shall be fully compatible with the gases and the gas supply system.
- All equipment, pipes, tubing, fittings, and accessories shall be manufactured by reputed suppliers.
- The project drawings are schematic and do not show the exact positions of pipe runs. Pipework shall be laid out in consultation with and to the satisfaction of the client/consultant. Complete shop drawings shall be submitted for approval prior to execution.
- All components shall be selected to operate safely at 1.5 times the specified working pressure.
- Credentials of the testing authority for safety valves and equipment shall be submitted for approval along with equipment submittals.
- Original test certificates for all safety valves and equipment shall be provided to the client at the time of completion/handling over, and copies shall be included in the O&M manuals.
- All necessary gauges shall be installed on the pipelines to monitor pressures and system performance. Operating and maximum safe working pressures shall be clearly marked on the gauges and shall be legible from a standing position under normal lighting conditions.
- Valves shall close clockwise when facing the handle from the top. An arrow and the word "CLOSE" shall be clearly cast, forged, or stamped on the handwheel to indicate the direction of operation.
- Shut-off valves shall be operable by personnel standing at floor level.
- Piping shall be provided with all necessary isolating valves to allow repair or expansion of sections without shutting down or venting the entire system. Equipment requiring regular inspection, cleaning, or removal shall be provided with isolation arrangements.
- Pipe fittings fabricated by butt welding of pipes or tubes to form reducers, tees, bends, etc., shall be used. Compression fittings (tees, unions, reducers, etc.) are not acceptable in the main pipeline.
- Tubing and fittings shall be factory-cleaned and suitable for high-purity gas service.
- Tubing up to 1" OD shall be bright annealed. Tubing above 1" OD shall be supplied in annealed and pickled condition.
- Tube bending shall be carried out using appropriate tube bending tools. Bends shall be uniform and free from kinks, flats, or wrinkles.
- Compression/face seal fittings shall be installed strictly as per manufacturer recommendations. Fittings above ½" size shall be installed using hydraulic or pneumatic swaging machines.
- Upon completion of tubing installation, the entire system shall be flushed with high-purity nitrogen (99.999%) to remove all foreign particles and contaminants.

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- Pipes/tubes passing through masonry walls, beams, underground, foundations, etc., shall be routed through properly provided cut-outs or sleeves.
- The erection of tubing, valves, and fittings shall be carried out in accordance with the latest engineering practices, approved working drawings, specifications, and installation instructions.
- All erection and installation work shall be executed by skilled and experienced personnel.
- The use of asbestos or asbestos-containing materials is strictly prohibited.
- Welding requirements:
 - All piping and tubing joints shall be executed using orbital welding.
 - The argon gas used for welding shall be of ultra high purity (UHP) grade.

GAS TUBING

- Stainless steel instrument tubing shall be standard, metric, seamless, stainless steel Grade 316 tubing, as specified for the respective gases, and shall be suitable for welding.
- Tubing shall be manufactured in accordance with ASTM A269 and shall be marked to indicate size, material specification, and heat code. These shall be traceable to the manufacturer's records. Tubes shall be supplied in nominal 6 m lengths.
- The working pressure of tubing shall be as per the manufacturer's published data and shall be based on equations from ASME B31.3.
- Tube hardness shall not exceed 90 HRB or 200 HV. Tubing shall be free from scale, defects, and scratches, and shall be suitable for bending and flaring.
- Finish and jointing of tubing, such as bright annealed (polished) or pickled (unpolished), welded or threaded, shall be as per the requirements of specific gases. OD tolerances shall not exceed ± 0.076 mm for 3 mm OD tubing.
- Welding of stainless steel tubing shall be carried out using an orbital welding system.
- Tubing shall be supported using manufacturer-recommended support systems consisting of polypropylene clamps with SS304 cover plates, bolts, and nuts. Clamps shall be mounted on aluminium powder-coated profiles.
- Formed bends shall be used as far as practicable. Where manufactured bends are required, long-radius bends shall be used. Elbows are not permitted.
- Formed bends shall be executed on-site using tube bending machines specifically designed for the tubing used. Bends shall be made in long continuous lengths to minimize the number of welds.
- Threaded connections shall be made using appropriate tools such as tee or ratchet wrenches, swaging, and pre-swaging tools, as recommended or approved by the manufacturer.

10) MECHANICAL PERFORMANCE AND GUARANTEE

Mechanical Guarantee

Mechanical guarantee shall cover proper design, workmanship, and material of construction for all manufactured as well as bought-out items.

The bidder shall provide a guarantee against defective materials and workmanship for the complete scope of supply for a period of 12 months from the date of commissioning or 18 months from the date of supply, whichever is later. Any parts found defective during the guarantee period shall be repaired or replaced by the bidder at no additional cost.

Performance Guarantee

The system shall be designed to operate continuously and meet the specified performance parameters.

- Gas manifold leakage shall be factory tested to a maximum leak rate of 1×10^{-6} mbar·l/s using helium gas.
- All piping and pipe fittings shall be pneumatically tested at 1.5 times the design pressure.

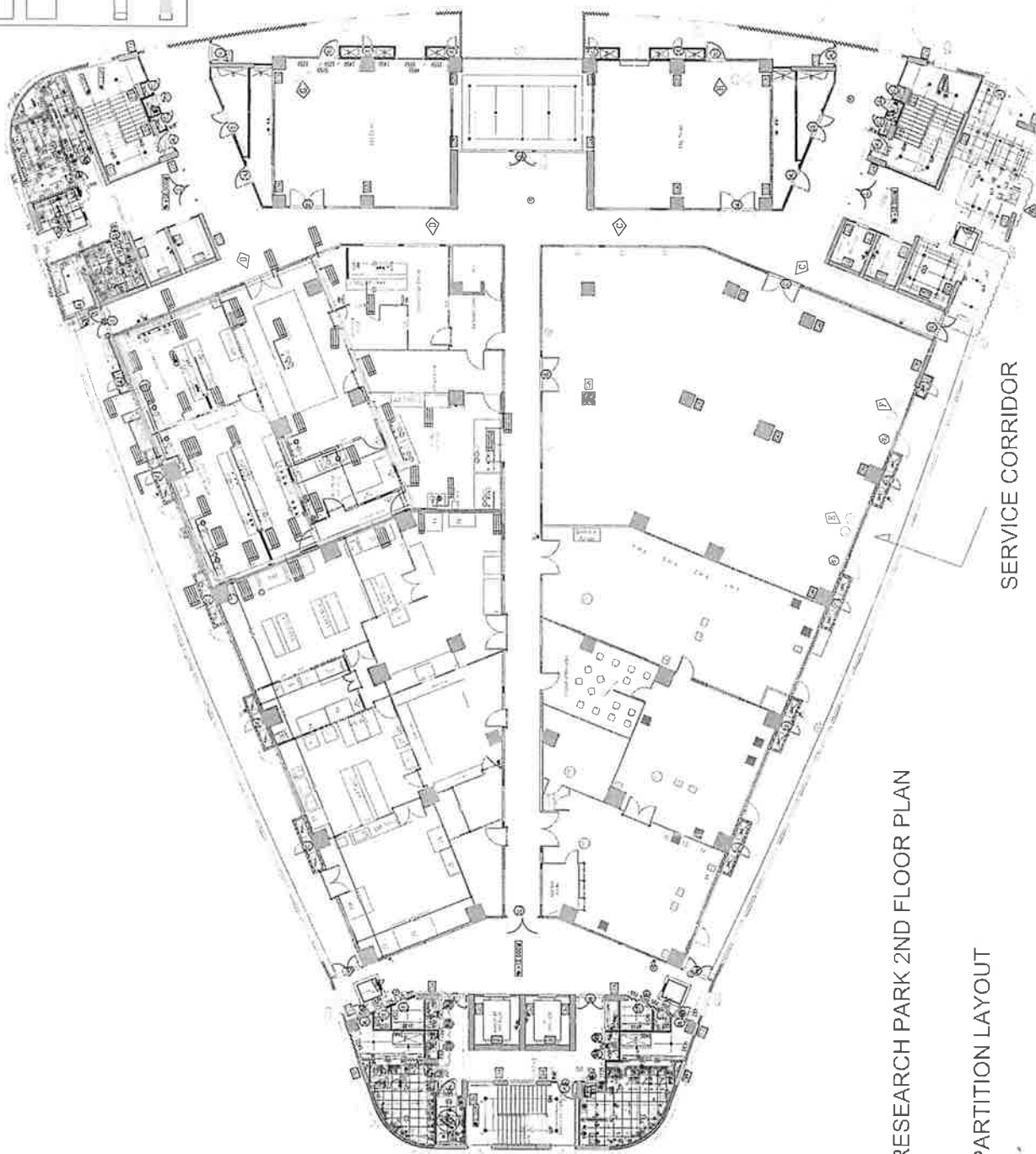


Centre of Excellence in Oil Gas & Energy (CoEOGE)

1.	Gas Distribution for Battery Lab
2.	P&ID for Battery Lab
3.	Gas Distribution for H2 Lab
4.	P&ID for H2 lab
5.	Gas Detection Layout for Battery Lab
6.	Gas Detection Layout for H2 Lab

LEGEND

	Existing Walls
	Proposed Walls
	Existing Doors
	Proposed Doors
	Existing Windows
	Proposed Windows
	Existing Stairs
	Proposed Stairs
	Existing Elevators
	Proposed Elevators
	Existing Mechanical Rooms
	Proposed Mechanical Rooms

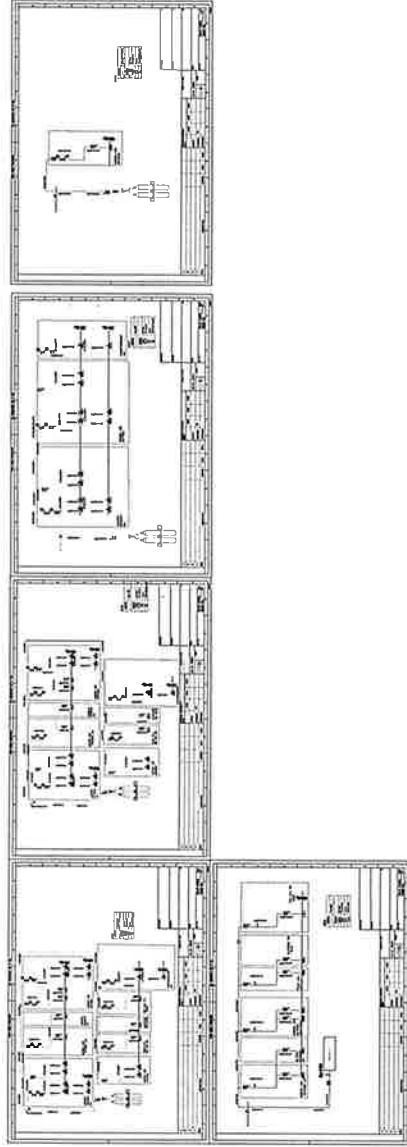


RESEARCH PARK 2ND FLOOR PLAN

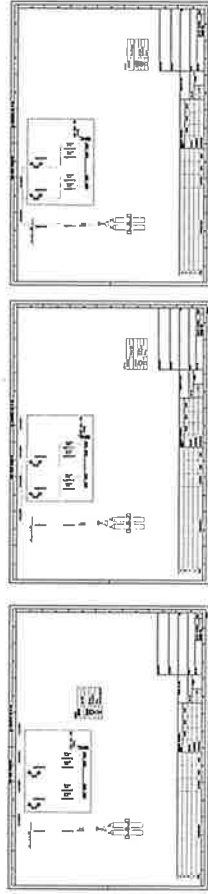
PARTITION LAYOUT

SERVICE CORRIDOR

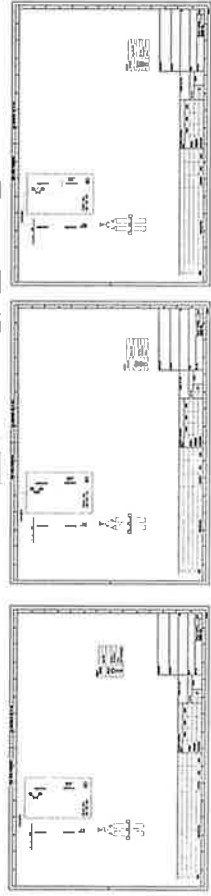
BATTERY LAB



GASES FOR GB

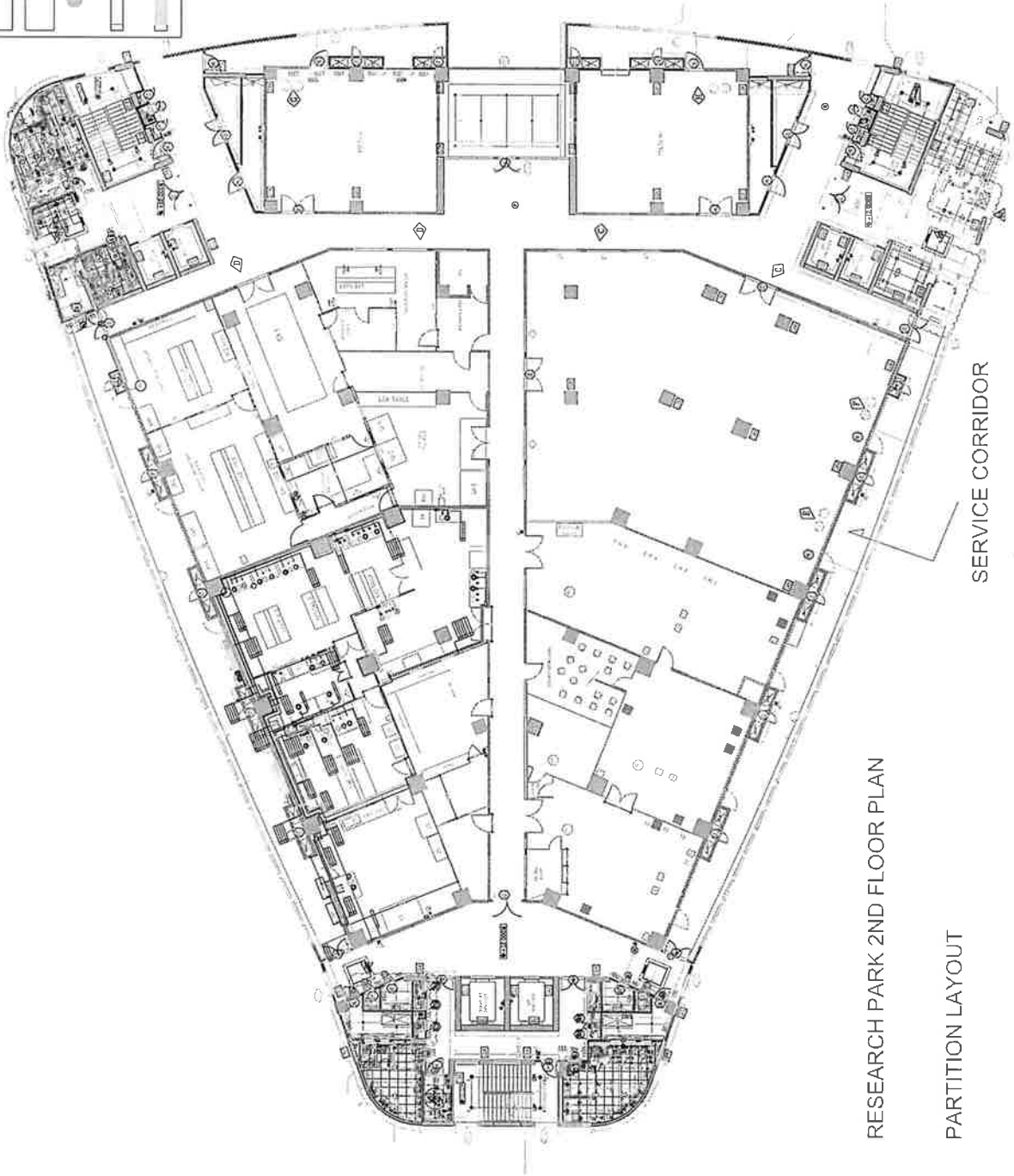


GASES FOR GB-1



LEGEND

	1000 sq ft room
	2000 sq ft room
	3000 sq ft room
	4000 sq ft room
	5000 sq ft room
	6000 sq ft room
	7000 sq ft room
	8000 sq ft room
	9000 sq ft room
	10000 sq ft room
	11000 sq ft room
	12000 sq ft room
	13000 sq ft room
	14000 sq ft room
	15000 sq ft room
	16000 sq ft room
	17000 sq ft room
	18000 sq ft room
	19000 sq ft room
	20000 sq ft room



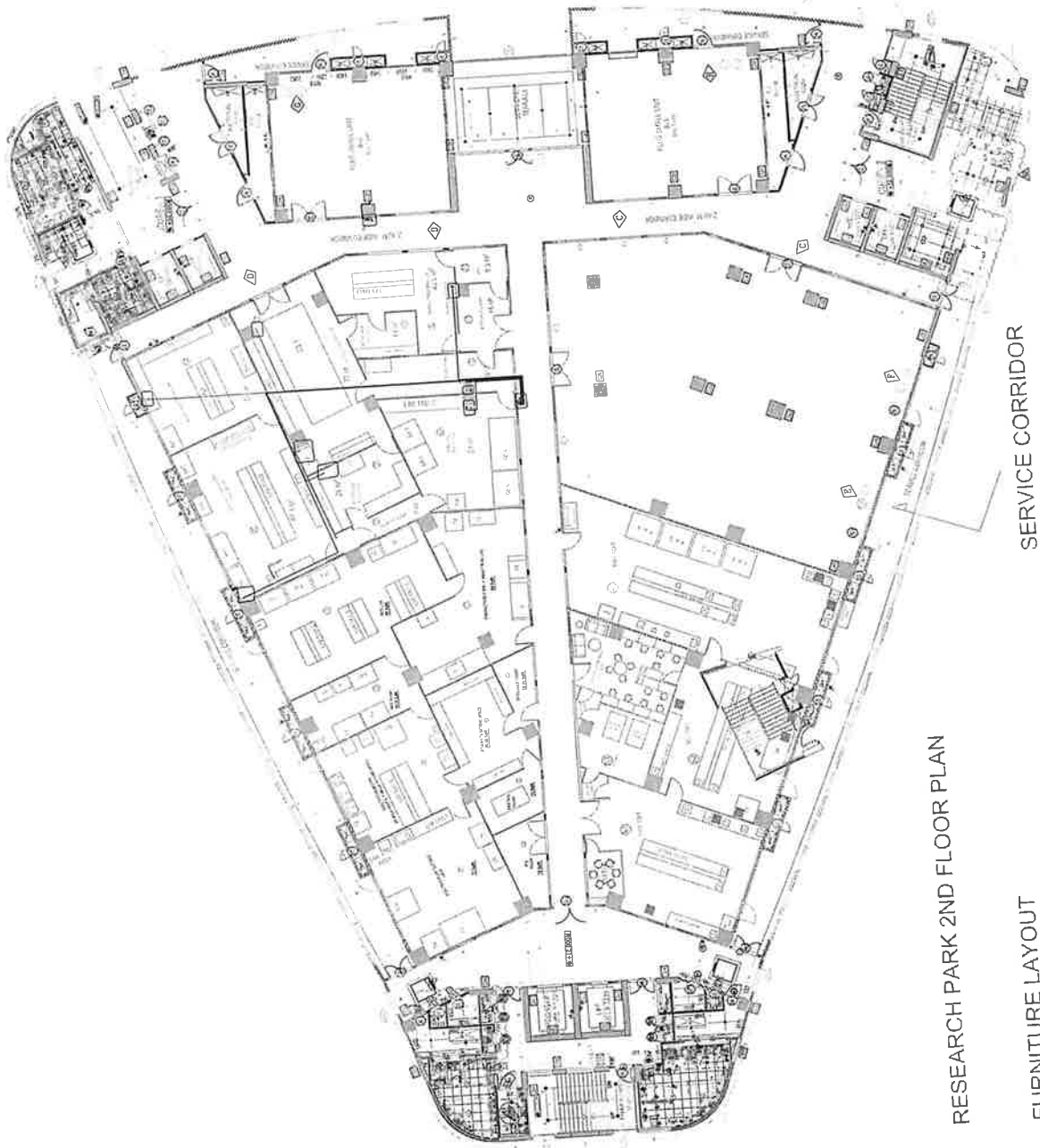
RESEARCH PARK 2ND FLOOR PLAN

PARTITION LAYOUT

SERVICE CORRIDOR

HYDROGEN LAB

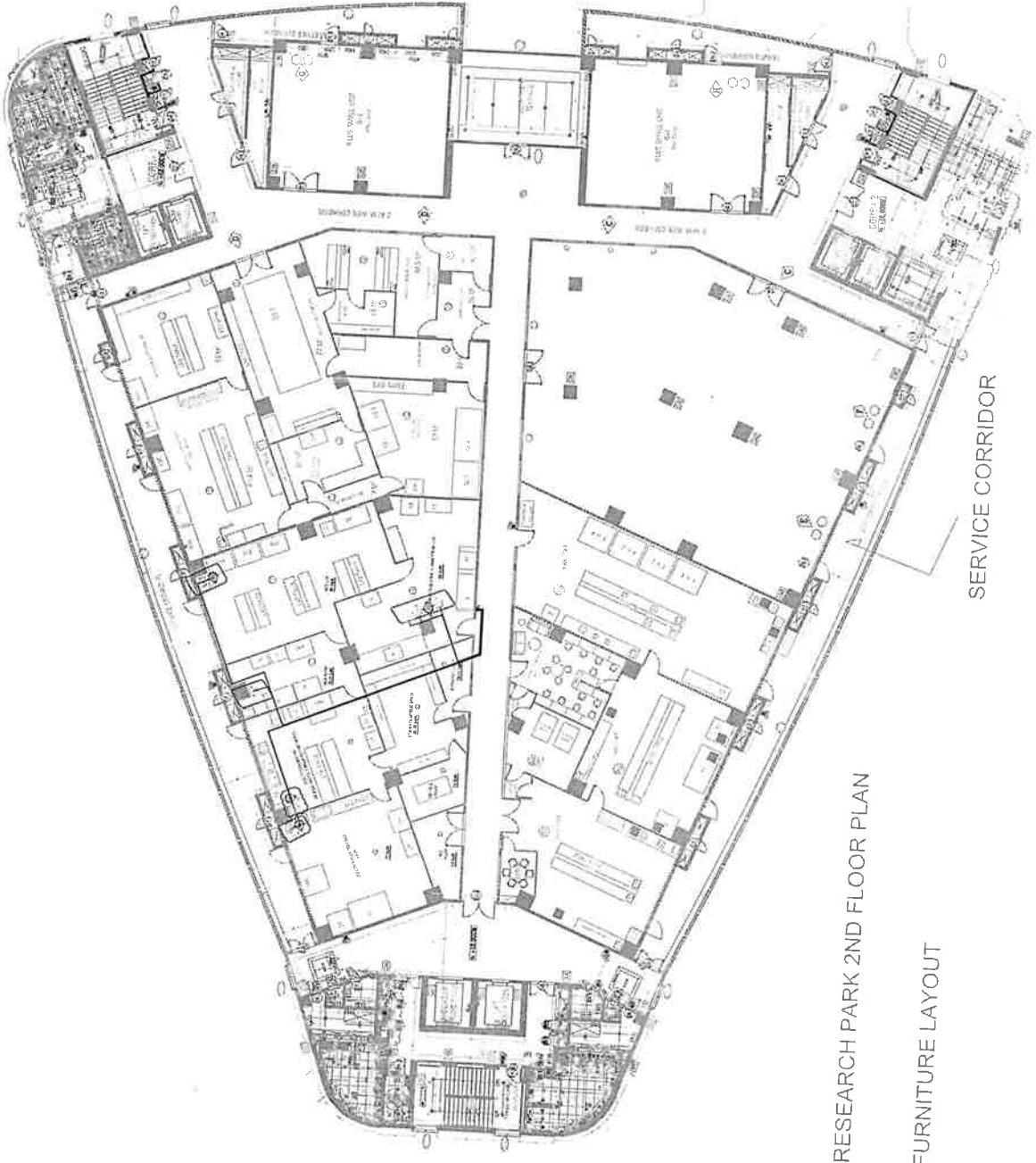




RESEARCH PARK 2ND FLOOR PLAN

FURNITURE LAYOUT

SERVICE CORRIDOR



RESEARCH PARK 2ND FLOOR PLAN

FURNITURE LAYOUT

SERVICE CORRIDOR

